



# CONCORDANCE OF VA CLINICIAN JUDGMENT OF TBI HISTORY WITH AMERICAN CONGRESS OF REHABILITATION MEDICINE-BASED/VA CRITERIA

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# OEF/OIF VETERANS AND TRAUMATIC BRAIN INJURY (TBI)

- High risk of TBI during OEF/OIF deployments
  - Blow to the head that disrupts brain functioning
  - Prevalence: 6-23%<sup>1-4</sup>
  - ~ 81% of Veteran TBI events are mild in severity<sup>5</sup>
  - Post-TBI health symptoms<sup>6</sup>
- In OEF/OIF Veterans...<sup>7</sup>
  - Posttraumatic Stress Disorder (PTSD) (58.2%)
  - Anxiety (28.3%)
  - Depression (42.3%)

# CRITERIA FOR DEFINING TBI SEVERITY

	VA Classification of TBI Severity		
	<b>ACRM Mild</b>	<b>Moderate</b>	<b>Severe</b>
<b>LOC</b>	0-30 min	>30 min and < 24 hrs	> 24 hrs
<b>PTA</b>	0-1 day	> 1 and < 7 days	> 7 days
<b>AOC</b>	a moment up to 24 hrs	> 24 hours. Severity based on other criteria	
Structural Imaging	Normal	Normal or Abnormal	Normal or Abnormal
Glasgow Coma Scale (best available score in first 24 hours)	13-15	9-12	< 9

# STUDY AIMS

- 1) To identify concordance of VA clinician judgment of deployment-related TBI history with ACRM/VA criteria
  - Stratified for mild, moderate, severe TBI
- 2) To identify factors associated with discordance
  - Clinician N/ACRM Y (~False negative/miss)

# COMPREHENSIVE TBI EVALUATION (CTBIE)

- ◉ Electronic protocol
- ◉ Etiology of injury
  - Blast
  - Non-blast (i.e. vehicular accidents, bullet wound, falls, other blunt trauma)
- ◉ Post-injury sequelae (LOC, AOC, PTA) and their duration
- ◉ Presence of suspected psychiatric conditions
- ◉ Neurobehavioral Symptom Inventory (NSI)<sup>10, 11</sup>
  - Affective
  - Somatosensory
  - Cognitive
  - Vestibular

# STUDY SAMPLE

- CTBIE between October 1, 2007-July 31, 2009
- Inclusion criteria
  - Clinician judgment of deployment-related TBI history (Yes/No)
  - ACRM/VA TBI criteria (LOC, AOC, PTA; durations)
- Exclusion criteria
  - TBI before or after returning from deployment
  - Inconsistent responses (e.g., Blast = no; #Blasts = 4)
- Final sample = 15,923

# DESIGN AND STATISTICAL ANALYSIS

- ◉ Retrospective database review
- ◉ Descriptive
  - Concordance rates of clinician judgment of deployment-related TBI history with ACRM/VA severity criteria
- ◉ Logistic Regression
  - Clinician N/ACRM Y ~ False negative/miss (target)
  - Clinician Y/ACRM Y ~ True positive/hit (reference)
- Independent Variables
  - Deployment-related events
  - Demographics
  - Suspected psychiatric conditions
  - NSI health symptoms

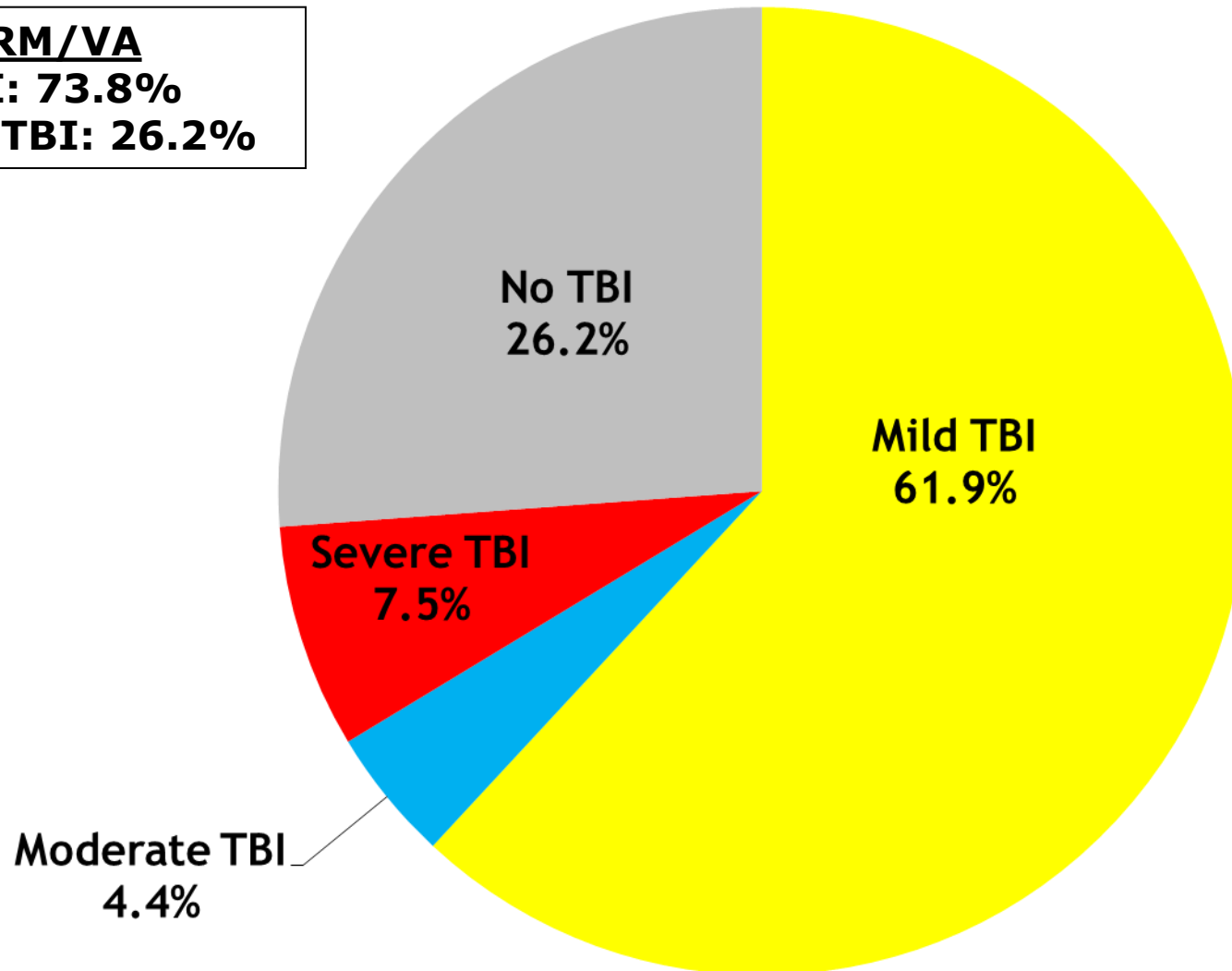
# RESULTS TABLE 1. SAMPLE CHARACTERISTICS (N = 15,923)

Characteristic	
Age	31.6 ± 8.8 years
Male	94.0%
Injury Etiology	
Blast + Non-Blast	40.7%
Blast only	39.0%
Non-Blast only	20.3%
Suspected psychiatric conditions	
PTSD	67.3%
Depression	39.4%
Anxiety Disorder(other than PTSD)	24.6%
NSI Health Symptoms (0 = none to 4 = very severe)	
Affective	2.25 ± 1.01
Cognitive	1.91 ± 1.10
Somatosensory	1.40 ± .77
Vestibular	1.12 ± .87



**FIGURE 1. PREVALENCE OF DEPLOYMENT-RELATED TBI HISTORY AND SEVERITY, BASED ON ACRM/VA CRITERIA (N = 15,923)**

**ACRM/VA**  
**TBI: 73.8%**  
**No TBI: 26.2%**



**TABLE 2. CLINICIAN JUDGMENT, GIVEN ACRM/VA  
CRITERIA FOR DEPLOYMENT-RELATED TBI HISTORY,  
STRATIFIED BY SEVERITY  
(N = 11,755)**

	TBI		
	Mild N = 9,858	Moderate N = 706	Severe N = 1,191
Clinician Y/ACRM Y (True Positive, Hit)	69.7%	89.4%	86.7%
Clinician N/ACRM Y (False Negative, Miss)	30.3%	10.6%	13.3%

**TABLE 3: LOGISTIC REGRESSION, ASSOCIATES TO CLINICIAN N/ACRM Y (MISS)**

	<b>Mild TBI History</b>
	<b>n = 9,615</b>
	<b>Column 1</b>
	<b>aOR (95% CI)</b>
<b>Injury Etiology (B+NB)</b>	
Blast only	.94 (.85-1.05)
Non-blast only	<b>1.32 (1.15-1.51)<sup>‡</sup></b>
LOC	.30 (.27-.33) <sup>‡</sup>
AOC	.69 (.55-.88) <sup>†</sup>
PTA	.49 (.44-.55) <sup>‡</sup>
<b>Age (years)(30+ vs. 25-29)</b>	<b>1.15 (1.01-1.30)<sup>†,‡</sup></b>
Sex (F vs. M)	1.09 (.89-1.34)
<b>NSI</b>	
Affective	<b>1.24 (1.14-1.34)<sup>‡</sup></b>
Somatosensory	.81 (.74-.90) <sup>‡</sup>
Cognitive	.79 (.73-.84) <sup>‡</sup>
Vestibular	.85 (.79-.93) <sup>‡</sup>
<b>Suspected</b>	
PTSD	.73 (.65-.82) <sup>‡</sup>
Depression	.95 (.85-1.05)
Anxiety	.85 (.75-.95) <sup>†</sup>

<sup>‡</sup>p ≤ .001, <sup>†</sup>p ≤ .01

TABLE 3: LOGISTIC REGRESSION, ASSOCIATES TO CLINICIAN N/ACRM Y (MISS)

	Mild TBI History n = 9,615	Moderate TBI History n = 692
	Column 1	Column 2
	aOR (95% CI)	aOR (95% CI)
Injury Etiology (B+NB)		
Blast only	.94 (.85-1.05)	1.20 (.63-2.30)
Non-blast only	1.32 (1.15-1.51) <sup>‡</sup>	2.63 (1.35-5.11) <sup>‡</sup>
LOC	.30 (.27-.33) <sup>‡</sup>	.28 (.15-.52) <sup>‡</sup>
AOC	.69 (.55-.88) <sup>†</sup>	.41 (.15-1.12) <sup>  </sup>
PTA	.49 (.44-.55) <sup>‡</sup>	.71 (.31-1.63)
Age (years)(30+ vs. 25-29)	1.15 (1.01-1.30) <sup>†,‡</sup>	ns
Sex (F vs. M)	1.09 (.89-1.34)	1.15 (.31-4.25)
NSI		
Affective	1.24 (1.14-1.34) <sup>‡</sup>	1.09 (.69-1.72)
Somatosensory	.81 (.74-.90) <sup>‡</sup>	.74 (.43-1.26)
Cognitive	.79 (.73-.84) <sup>‡</sup>	.84 (.56-1.24)
Vestibular	.85 (.79-.93) <sup>‡</sup>	.93 (.62-1.41)
Suspected		
PTSD	.73 (.65-.82) <sup>‡</sup>	.93 (.49-1.77)
Depression	.95 (.85-1.05)	.91 (.52-1.59)
Anxiety	.85 (.75-.95) <sup>†</sup>	1.14 (.62-2.11)

<sup>‡</sup>p ≤ .001, <sup>†</sup>p ≤ .01

TABLE 3: LOGISTIC REGRESSION, ASSOCIATES TO CLINICIAN N/ACRM Y (MISS)

	Mild TBI History n = 9,615	Moderate TBI History n = 692	Severe TBI History n = 912
	Column 1	Column 2	Column 3
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Injury Etiology (B+NB)			
Blast only	.94 (.85-1.05)	1.20 (.63-2.30)	1.60 (.92-2.78) <sup>  </sup>
Non-blast only	1.32 (1.15-1.51) <sup>‡</sup>	2.63 (1.35-5.11) <sup>‡</sup>	1.03 (.62-1.69)
LOC	.30 (.27-.33) <sup>‡</sup>	.28 (.15-.52) <sup>‡</sup>	.24 (.16-.38) <sup>‡</sup>
AOC	.69 (.55-.88) <sup>†</sup>	.41 (.15-1.12) <sup>  </sup>	.49 (.20-1.18)
PTA	.49 (.44-.55) <sup>‡</sup>	.71 (.31-1.63)	.29 (.07-1.23) <sup>  </sup>
Age (years)(30+ vs. 25-29)	1.15 (1.01-1.30) <sup>†,‡</sup>	ns	ns
Sex (F vs. M)	1.09 (.89-1.34)	1.15 (.31-4.25)	1.40 (.62-3.16)
NSI			
Affective	1.24 (1.14-1.34) <sup>‡</sup>	1.09 (.69-1.72)	1.38 (.98-1.94) <sup>  </sup>
Somatosensory	.81 (.74-.90) <sup>‡</sup>	.74 (.43-1.26)	.88 (.59-1.31)
Cognitive	.79 (.73-.84) <sup>‡</sup>	.84 (.56-1.24)	.68 (.51-.90) <sup>†</sup>
Vestibular	.85 (.79-.93) <sup>‡</sup>	.93 (.62-1.41)	.92 (.67-1.28)
Suspected			
PTSD	.73 (.65-.82) <sup>‡</sup>	.93 (.49-1.77)	.82 (.49-1.39)
Depression	.95 (.85-1.05)	.91 (.52-1.59)	1.07 (.69-1.68)
Anxiety	.85 (.75-.95) <sup>†</sup>	1.14 (.62-2.11)	.79 (.48-1.30)

## SUMMARY AND DISCUSSION

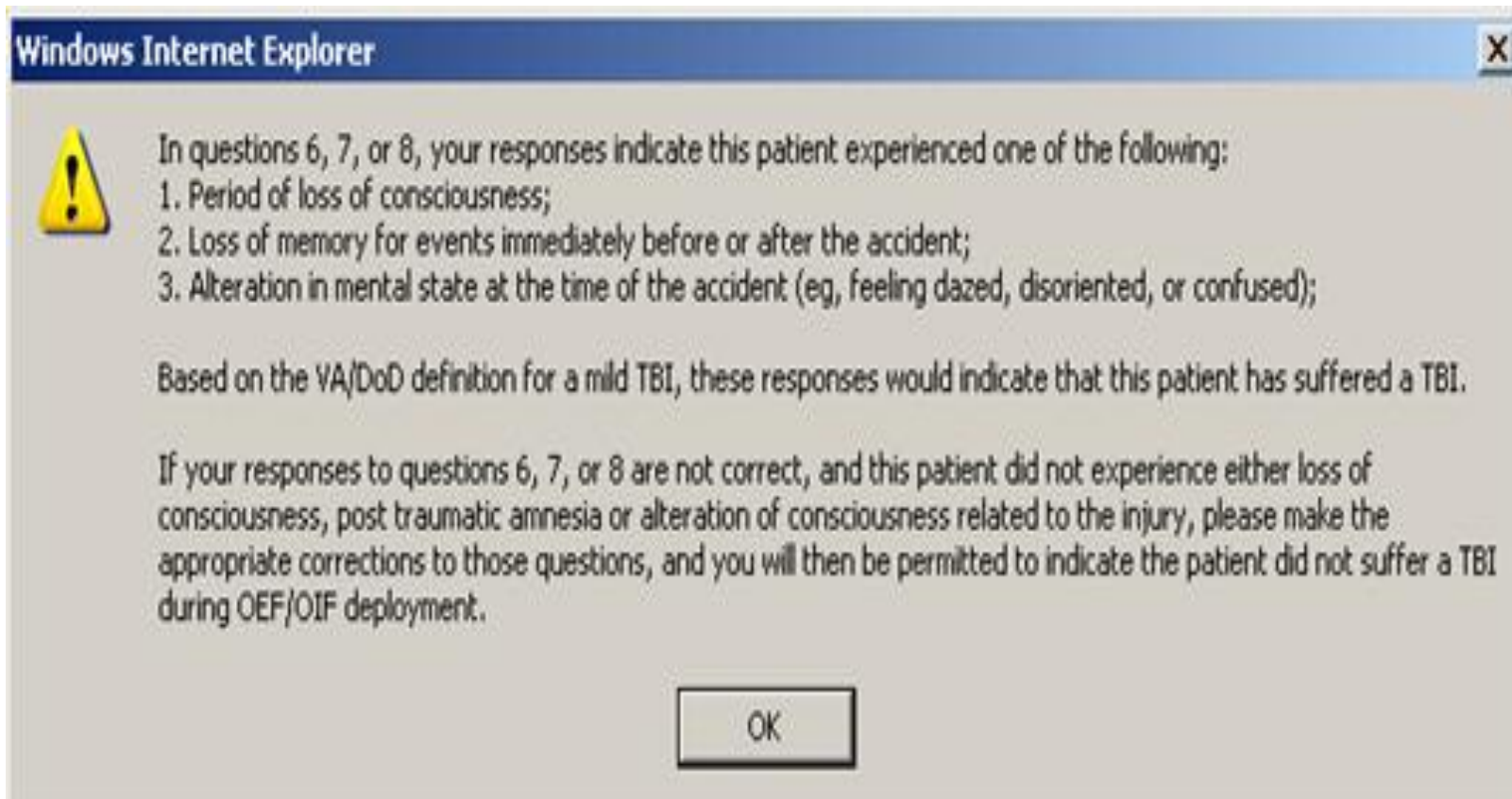
1. High agreement between clinicians and ACRM/VA criteria (77.5%)
  - Clinician Y/ACRM Y (True positives, Hits) (53.7%)
  - Clinician N/ACRM N (True negatives) (23.8%)
2. TBI severity rates, based on ACRM/VA criteria
  - Mild: 83.9%
  - Moderate: 6.0%
  - Severe: 10.1%
3. Disagreement (Clinician N/ACRM Y) observed more frequently for mTBI (30.3%)
  - Non-blast
  - Older age
  - Affective symptoms
4. Non-blast injury events may have been perceived as less severe, and NSI affective symptoms (e.g., fatigue, irritability, sadness) interpreted as readjustment difficulties for older Veterans.

# LIMITATIONS

- ◉ Nature of clinician-patient conversations that led to clinical decision unknown.
- ◉ Unknown provider-level characteristics (e.g., specialty, level of TBI expertise)
- ◉ Data are from FY2008-09, will not reflect current evaluation practices.

## NEW CTBIE TEMPLATE PREVENTS INCONSISTENT CONCLUSIONS

**“If this patient did not experience either LOC, PTA, or AOC....please make the appropriate corrections.”**





# IMPLICATIONS

- ⦿ Automating CTBIE template to be consistent with ACRM/VA-based TBI history criteria will lead to more reliable rates of:
  - Deployment-related TBI history
  - Symptom persistence
  - Symptom resolution

# FUTURE DIRECTIONS

- ⦿ How do the different outcome groups compare in post-CTBIE:
  - ⦿ VA health care utilization
  - ⦿ Health outcomes
  - ⦿ Satisfaction with VA health care

# THANK YOU

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## NSI-23 SYMPTOMS INCLUDE...<sup>11</sup>

Subscale	Symptom examples
Affective	<ul style="list-style-type: none"><li>• Low frustration tolerance</li><li>• Irritability</li><li>• Anxiety/tension</li></ul>
Somatosensory	<ul style="list-style-type: none"><li>• Noise sensitivity</li><li>• Vision problems</li><li>• Headaches</li></ul>
Cognitive	<ul style="list-style-type: none"><li>• Difficulties getting organized/can't finish things</li><li>• Forgetfulness</li><li>• Difficulties making decisions</li></ul>
Vestibular	<ul style="list-style-type: none"><li>• Loss of balance</li><li>• Feeling dizzy</li><li>• Poor coordination/clumsy</li></ul>

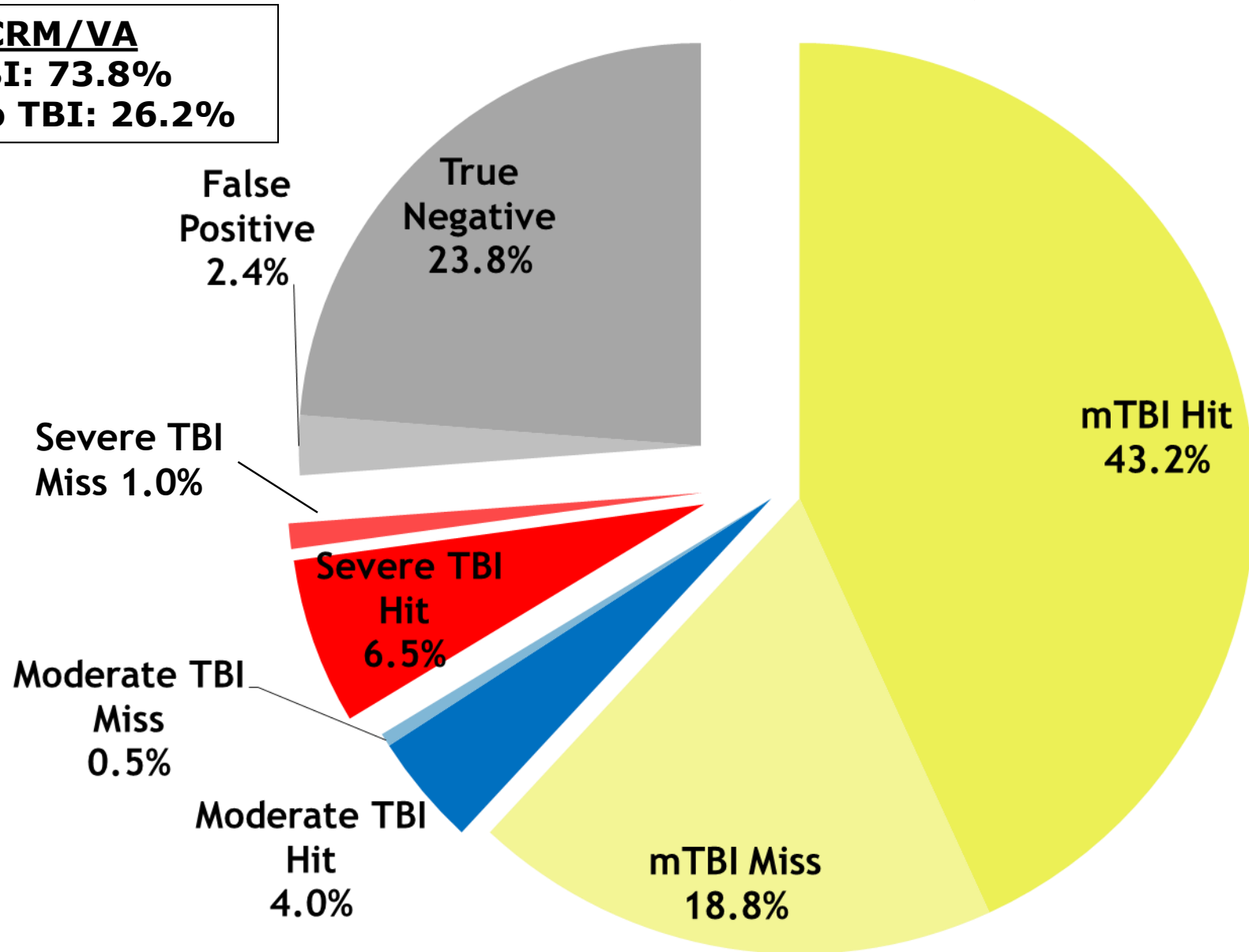
# COMPREHENSIVE TBI EVALUATION (CTBIE)

- ◉ Electronic protocol
- ◉ Etiology of injury
  - Blast
  - Non-blast (i.e. vehicular accidents, bullet wound, falls, other blunt trauma)
- ◉ Post-injury sequelae (LOC, AOC, PTA) and their duration
- ◉ Presence of suspected psychiatric conditions
- ◉ Neurobehavioral Symptom Inventory (NSI)<sup>10, 11</sup>
  - Affective
  - Somatosensory
  - Cognitive
  - Vestibular

## TBI DIAGNOSIS OUTCOMES BETWEEN CLINICIAN JUDGMENT AND ACRM/VA CRITERIA (N = 15,923)

	Mild N = 9,858	Moderate N = 706	Severe N = 1,191	No TBI N = 4,168
True Positives	69.7	89.4	86.7	CR = 90.9
False Negatives	30.3	10.6	13.3	FA = 9.1
Age	30.8 ± 8.4	31.9 ± 9.5	31.4 ± 8.9	33.5 ± 9.4
Male	94.7	96.2	94.5	91.6
Blast + Non-Blast	43.3	48.1	47.3	30.2
Blast	39.6	30.3	30.0	42.2
Non-Blast Injury	17.1	21.7	22.7	27.7
PTSD	70.8	79.5	76.3	54.3
Depression	39.3	45.9	46.5	36.7
Anxiety Disorder (other than PTSD)*	23.8	25.6	27.1	25.5

**FIGURE 1. CONCORDANCE OF CLINICIAN JUDGMENT WITH  
ACRM/VA CRITERIA (N = 15,923)**



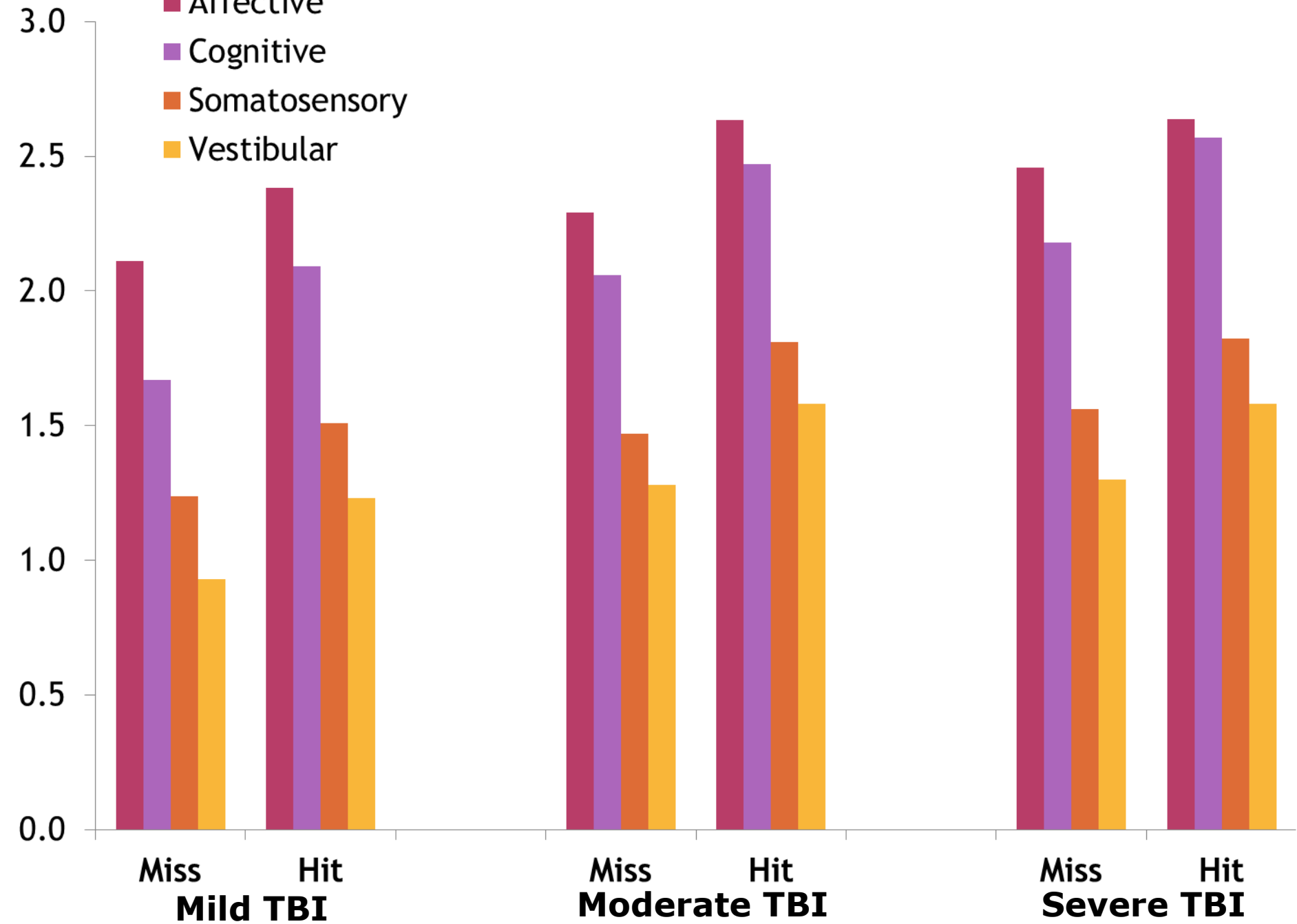


# LIMITATIONS

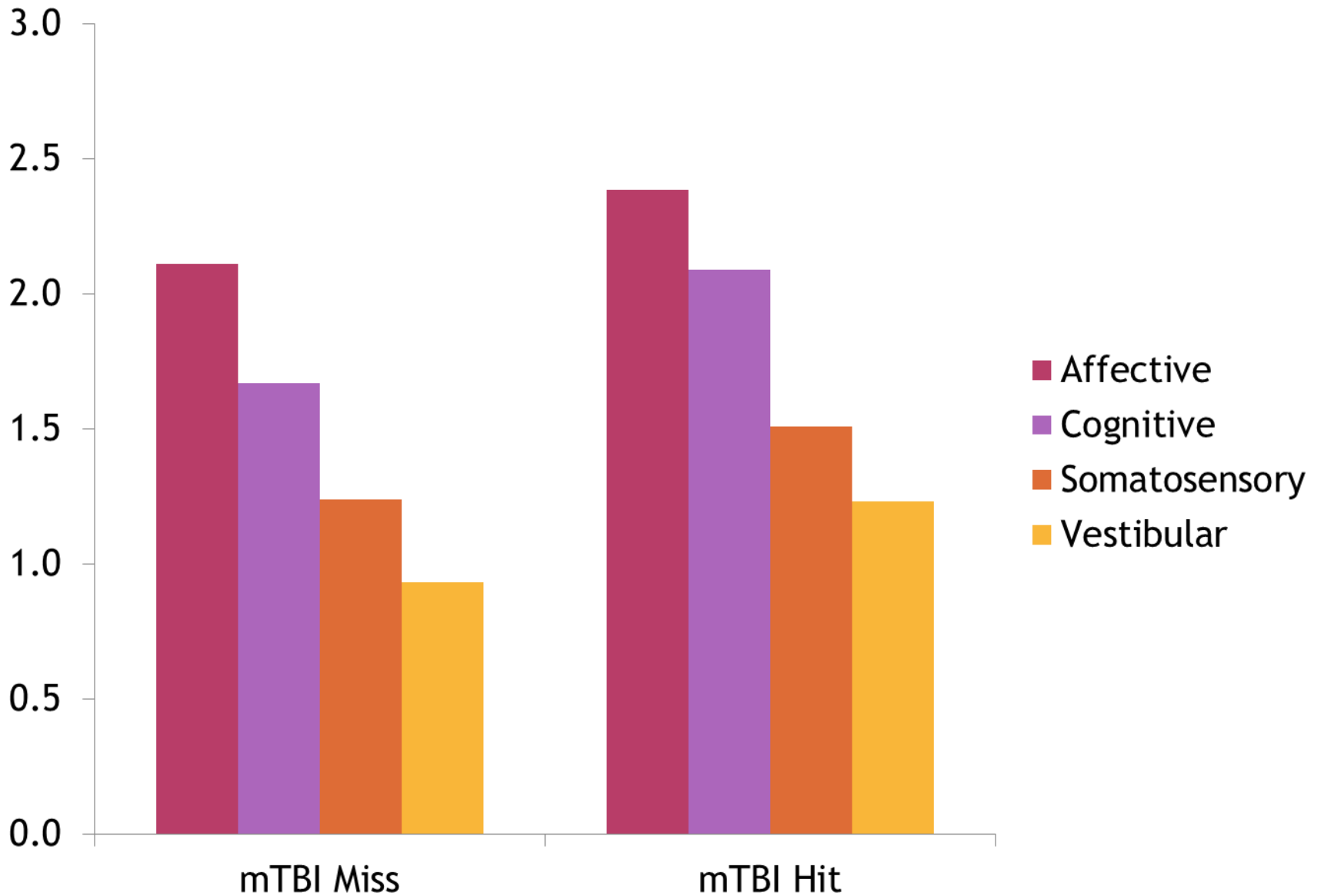
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# NSI ACROSS TBI SEVERITY GROUPS

- Affective
- Cognitive
- Somatosensory
- Vestibular



# NSI-22 FOR MTBI GROUPS



# ACRM CRITERIA FOR IDENTIFYING MTBI<sup>8,9</sup>

A traumatically induced physiological disruption of brain function, as manifested by at least one of the following:

- Loss of consciousness (LOC)
- Alteration of consciousness (AOC)
- Posttraumatic amnesia (PTA)
  
- Focal neurologic deficit(s) that may or may not be transient (e.g., loss of balance, change in vision)
- Intracranial lesion

# CTBIE QUESTIONS

- ◉ Did you **lose consciousness** immediately after any of these experiences? (yes, no, uncertain)
- ◉ Did you experience a period of **disorientation or confusion** immediately following the incident? (yes, no, uncertain)
- ◉ Did you experience a period of **memory loss** immediately before or after the incident? (yes, no, uncertain)
- ◉ Q23. Is the history and clinical course consistent with a diagnosis of TBI? (yes, no)

# OTHER CTBIE QUESTIONS

- ◉ If yes or suspected/probable, symptoms of which disorders?
  - Depression
  - PTSD
  - Anxiety disorder (other than PTSD)